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13. ABSTRACT *(Maximum 200 words)*

THE PURPOSE OF THIS STUDY WAS TO QUICKLY ASSESS THE CURRENT CHEMICAL CHARACTERISTICS AND FLOW RATES OF WASTES INTO THE CHEMICAL SEWER LINE TO BASIN F. SAMPLES AT VARIOUS LOCATIONS IN THE CHEMICAL WASTE SEWER SYSTEM WERE TAKEN AND CHEMICALLY ANALYZED. SHELL CHEMICAL COMPANY (SCC) WAS CONDUCTING PRODUCTION OPERATIONS DURING THIS PERIOD. RESULTS OF THIS STUDY INDICATE THE FOLLOWING: (1) THE CURRENT INPUT TO BASIN F IS REPRESENTATIVE OF THE SCC OUTPUT AT THEIR PLANT; (2) RESIDUAL QUANTITIES OF PESTICIDES REPRESENTING PAST SCC PRODUCTION (A.G., NEMAGON, ALDRIN, DIELDRIN, ETC.) WERE DETECTED IN MEASURABLE QUANTITIES IN THE CHEMICAL SEWER WASTE STREAM; (3) SCC OPERATIONS ARE CURRENTLY RESPONSIBLE FOR WELL OVER 90% OF ALL WASTE FLOW INTO THE CHEMICAL WASTE SEWER LINE TO BASIN F.

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TEST REPORT

SAMPLING AND ANALYSIS OF INFLUENT TO BASIN F AT ROCKY MOUNTAIN ARSENAL

25 through 31 January 1978

OFFICE OF THE PROJECT MANAGER
FOR
CHEMICAL DEMILITARIZATION AND INSTALLATION RESTORATION
ABERDEEN PROVING GROUND, MARYLAND 21010

TMENT OF THE ARMY
THE PROJECT MANAGER FOR
CHEMICAL DEMILITARIZATION AND INSTALLATION RESTORATION
ABERDEEN PROVING GROUND, MARYLAND 21010

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3 Feb 78

SUBJECT: Shell Chemical Company Waste Water Discharge at Rocky Mountain Arsenal

Commanding General
U. S. Army Armament
Materiel Readiness Command
Rock Island, Illinois 61299

1. In accordance with the direction received during the 25 Jan 78 meeting on the above subject, sampling and analysis of the effluent from Shell Chemical Company's Rocky Mountain Arsenal operations has been completed. A report is attached as Inclosure 1.

2. The work was accomplished in an expedited manner and, therefore, represents only a few days of sampling and analysis effort. However, even this limited sampling verifies that Shell Chemical Company is the primary contributor of wastes to the chemical waste sewer line to Basin F and that these wastes are representative of pesticide manufacture products and by-products from both past and current operations. No significant current chemical wastes attributable to Army operations were found.

3. This study confirms that efforts to eliminate hazardous wastes by Shell to date have been unsuccessful and, thus, the burden of handling these toxic chemicals remains with the Army.

4. Recommend that a follow-on program be initiated to assess, on a routine basis, the current chemical characteristics and flow rates of Shell's waste into the chemical sewer line to Basin F.

1 Incl
as

FRANK A. JONES, JR.
Colonel, CmlC
Project Manager for
Chemical Demilitarization
and Installation Restoration

CF:
DARCOM, ATTN: DRCIS-E/COL A. Lawrence (cy sent to Col Lawrence 10 Feb 78)
RMA, ATTN: SARRM-CO

SAMPLING AND ANALYSIS OF INFLUENT

TO BASIN F AT ROCKY MOUNTAIN ARSENAL

25 through 31 January 1978

ALONZO WILLIAMS, JR.
LTC (P), CmlC
Commanding
Rocky Mountain Arsenal

FRANK A. JONES, JR.
Colonel, CmlC
Project Manager for
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and Installation Restoration

Executive Summary

Rocky Mountain Arsenal (RMA), Commerce City, Colorado, was established in 1942 to manufacture toxic chemical and incendiary munitions. Military operations have included production of GB, Lewisite, mustard, arsenous chloride, chlorine, and white phosphorus munitions. Demilitarization of some of these products and blending of hydrazine fuel have been additional missions at RMA. Portions of the industrial plants area have been leased since 1946 for the manufacture of commercial chemicals. Shell Chemical Company (SCC) has been a lessee since 1952 and has produced various pesticides and herbicides since that time. Under conditions of the lease/utility service agreement with SCC, the Army has been responsible for accepting chemical waste discharge from the lessee operations. Disposal has been accomplished by discharge into waste basins located on the arsenal (see Figure 1). Since 1957, all chemical wastes have been discharged into a chemical waste sewer line that terminates into an asphalt lined basin (Basin F) (see Figure 2). Recent studies have shown that the chemical waste sewer line is leaking, and there are indications that Basin F is leaking.

The purpose of this study was to quickly assess the current chemical characteristics and flow rates of wastes into the chemical sewer line to Basin F. Samples at various locations in the chemical waste sewer system were taken on 26, 27 and 28 Jan 78, and chemically analyzed. SCC was conducting production operations during this period. Results of this study indicate the following.

a. The current input to Basin F is representative of the SCC output at their plant. The major organic and inorganic constituents detected in the chemical process waste stream are representative of current products and by-products emanating from the SCC operation. These chemicals, if released to groundwater, could represent a future contamination problem if they should migrate across arsenal boundaries above standards or guidelines (see Table 7 for published standards or guidelines).

b. Residual quantities of pesticides representing past SCC production (e.g., nemagon, aldrin, dieldrin, etc.) were detected in measurable quantities in the chemical sewer waste stream.

c. Analysis indicates no evidence of hazardous wastes attributable to RMA operations either past or current, although current operations are minimal.

d. SCC operations are currently responsible for well over 90% of all waste flow into the chemical waste sewer line to Basin F. Flow measured during this period averaged 52 gpm. Total soluble organic content of the waste stream was approximately 0.17% of total flow.

A. Introduction.

Rocky Mountain Arsenal (RMA), Commerce City, Colorado, has been the site of chemical manufacturing and demilitarization operations since World War II to the present. Since 1946, a portion of the site has been leased for the private manufacture of chemicals. Shell Chemical Company (SCC) has leased the plant area since 1952 and produced various pesticides and herbicides there since that time. Under conditions of the lease with SCC, the Army has been responsible for chemical process waste water disposal. Disposal has been accomplished by discharge into waste basins located on the arsenal (see Figure 1).

On 26, 27 and 28 Jan 78 (Thursday, Friday and Saturday), samples were taken from the chemical waste water line which is fed by various manufacturing processes. That line terminates in Basin F (see Figure 2). Analysis of these samples was conducted on 29, 30 and 31 Jan 78.

Contributors to the chemical waste stream include RMA Army operations and the Shell Chemical Company. The Army's contribution is the result of ton-container burning, hydrazine blending operations, the associated laundry waste water, and waste from the laboratories which support the Chemical Demilitarization and Installation Restoration programs. SCC's current products are five insecticides (azodrin, bidrin, ciodrin, nudrin, and vapona), a herbicide (atrazine), and a compound which is an ingredient for an animal wormer drug (technical grade DDVP). Over the last year Shell has been the predominant user of the waste line accounting for well over 90% of the flow.

During the course of the 3-day sampling, the Army's flow was essentially zero while the volume of Shell's effluent was estimated at 52 gallons per minute. During the sampling period, SCC was in production of bidrin, atrazine, vapona and nudrin.

The following sections of this report provide information on the 6-day sampling and analysis effort and on the results of that effort. This data is also compared with data which has been provided by SCC over the last two years in the form of weekly reports. The section of the report which follows directly provides some background information on waste water discharges. Conclusions are made in the final section of the report.

B. History.

1. Waste System.

During World War II and through 1956, wastes from Army arsenal operations and SCC were disposed of in Basin A (refer to Figure 1 throughout the course of the historical discussion). Because of a civil suit which charged that Basin A was polluting the groundwater, Basin F was designed.

Construction of Basin F and the sewer lines from both plants areas were completed in 1956. Also at that time, the contents of Basin A, estimated at 60 million gallons, were pumped into Basin F.

Basin F was created from a natural depression and after minor grading operations was covered with a 3/8" blown asphalt membrane to prevent penetration of waste liquids to the groundwater. It has a 243 million gallon capacity, spans 93 acres, and has an average depth of 10 feet. Current content is estimated at 163 million gallons.

2. Shell Chemical Company Operations.

In 1952, Shell Chemical Company purchased the Julius Hyman & Company, the original lessee, and in 1967, a second 20-year lease was signed between the Dept of the Army and Shell. Since 1965, and as a condition to a supplemental agreement to the lease, the Government provides waste disposal service for a fee which was based on the previously estimated cost for providing the service.

Since 1965, Shell has discharged an estimated 572 million gallons of waste water into the waste system. During the 1965 to 1977 period, Shell has been in production of the following chemicals: aldrin (insecticide), akton (insecticide), azodrin (insecticide), atrazine (herbicide), bidrin (insecticide), bladex (herbicide), ciodrin (insecticide), dibrom, DDVP, dieldrin (insecticide), endrin (insecticide), gardona (insecticide), landrin (insecticide), naled (insecticide), nemagon (soil fumigant), nudrin (insecticide), parathion, supona (insecticide), and vapona (insecticide).

In 1970, the Army advised Shell that plans were being made to discontinue the use of Basin F. On that basis, Shell explored several waste disposal alternatives including a waste treatment plant. That plant has recently been completed at a construction cost of $18M. However, initial testing of the treatment plant has shown that it is not capable of totally removing all wastes generated by Shell as it is presently configured. Since its start-up in April 1977, the plant has reduced the quantity of discharge by about 1/3 and has achieved a significant copper, nitrogen and high volatile organic removal from the waste stream.

C. Study Results.

1. In response to a requirement to expeditiously characterize the wastes emanating from the plants area of RMA, five sampling points were established as follows (see Figure 2):

a. East Meter Pit, Shell Chemical Company.

b. West Meter Pit, Shell Chemical Company.

c. Manhole 3-5, 50' north of 7th Avenue and 800' west of "D" Street.

d. Manhole 1-7, weir box along "D" Street.

e. Basin F influent -- input at basin pipe.

The exact sample collection time and dates with estimated flow rates are shown on Tables 1-3. The west meter was closed for cleaning operations on 26 and 27 Jan 78 and was not available for chemical analysis. Actual and estimated flow rates from the east and west meters of the Shell Chemical Company indicated that the meters are generally measuring above actual flow encountered.

2. Assessment of RMA Flow Rates.

a. RMA Laundry: Current operations are on a minimum basis. Two employees are washing one or two loads a day. No clothing impregnation or dry cleaning operations are in effect that would contribute solvents or chemicals into the sewer from the laundry. Current operations utilize soda ash and soap, laundry Type I chips, Norman Fox and Company, Vernon, California, P. O. D-W-55626-1, Lot 90058-32.

b. Hydrazine Blending: Current hydrazine blending operations are at a very low level. The sump at the hydrazine blending is sumped periodically when required (before 60,000 gallon capacity is reached). The last sump dump into the contaminated sewer was in Dec 77, with approximately 40,000 gallons pumped into the sewer. The hydrazine sump is neutralized with calcium hypochlorite until the UDMH level is reduced to 1 ppm prior to pumping into the sewer.

c. Phosgene Operations: Phosgene transfer operations have been stopped since Jun 77.

d. Ton Container Burn: The furnaces are operating five days a week, with some GB ton containers and bonnets being burned. The scrubbers at this facility were dumped in Dec 77 and again in Jan 78, with approximately 4,000 gallons of sodium carbonate being added to the sewer each month.

e. RMA Laboratories: Both the MALD and EALD add small volumes of dilute concentrations to the sewer on a daily basis.

f. GB Plant: No flow indicated.

3. Results of Chemical Analysis.

Tables 4-5 address the compounds identified by the sampling and analysis program and the procedures used in sample analysis. Table 6 indicates the Shell production schedule during the sampling period. Table 7 is provided for reference and represents applicable environmental standards/guidelines. These standards/guidelines would only apply if the identified chemicals were to leak into groundwater and migrate across arsenal boundaries to the surrounding communities. Figure 3 was added to show the physical appearance of Basin F contents and samples at several locations.

D. Conclusions.

Conclusions drawn from this study are as follows:

1. The current input to Basin F is representative of the SCC output at their plant. The major organic and inorganic constituents detected in the chemical process waste stream are representative of current products and by-products emanating from the SCC operation. These chemicals, if released to groundwater, could represent a future contamination problem if they should migrate across arsenal boundaries above standards or guidelines (see Table 7 for published standards or guidelines).

2. Residual quantities of pesticides representing past SCC production (e.g., nemagon, aldrin, dieldrin, etc.) were detected in measurable quantities in the chemical sewer waste stream.

3. Analysis indicates no evidence of hazardous wastes attributable to RMA operations, either past or current.

4. SCC operations are currently responsible for well over 90% of all waste flow into the chemical waste sewer line to Basin F. Flow measured during this period averaged 52 gpm. Total soluble organic content of the waste stream was approximately 0.17% of total flow.

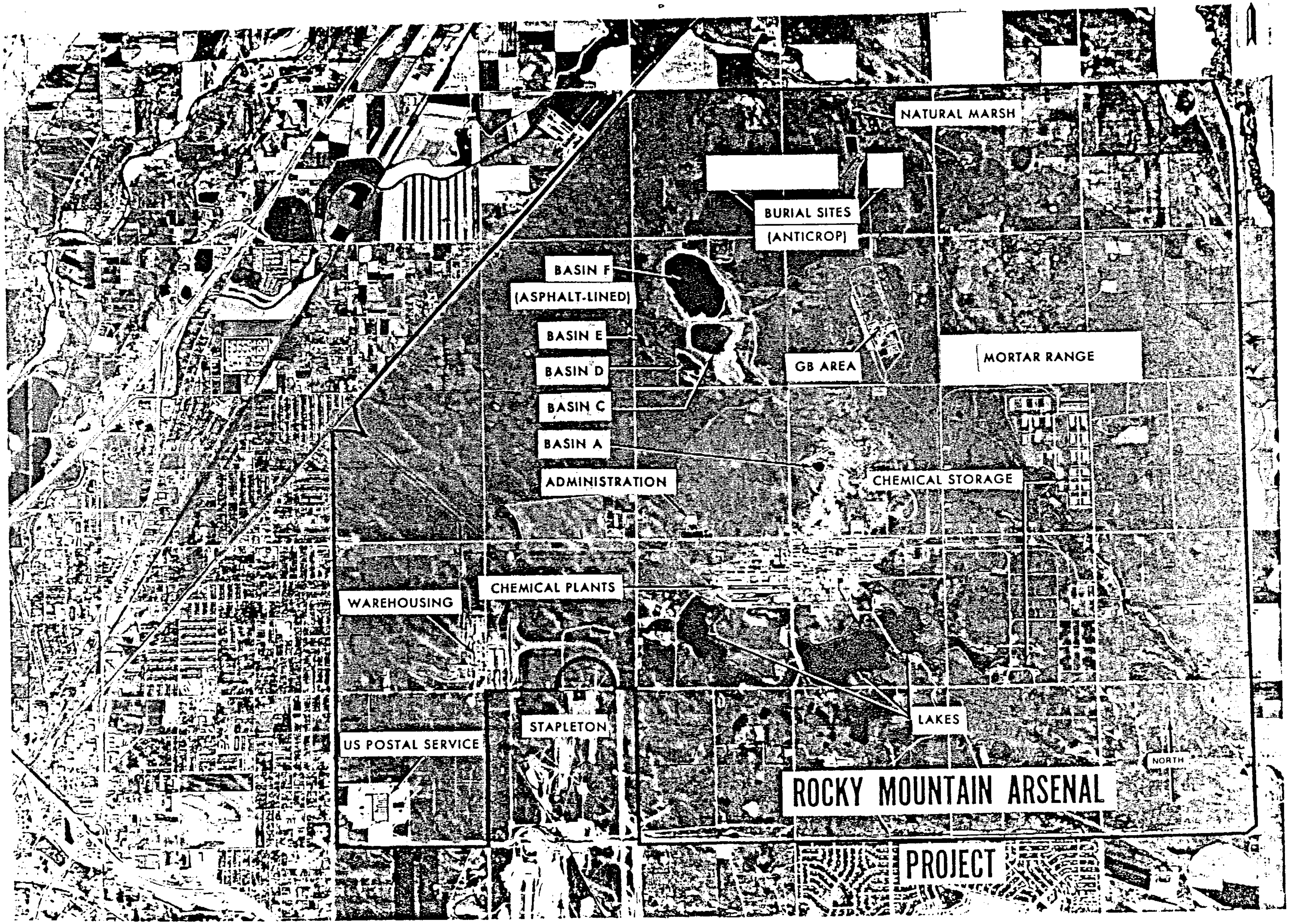


FIGURE 1: Aerial View of Rocky Mountain Arsenal

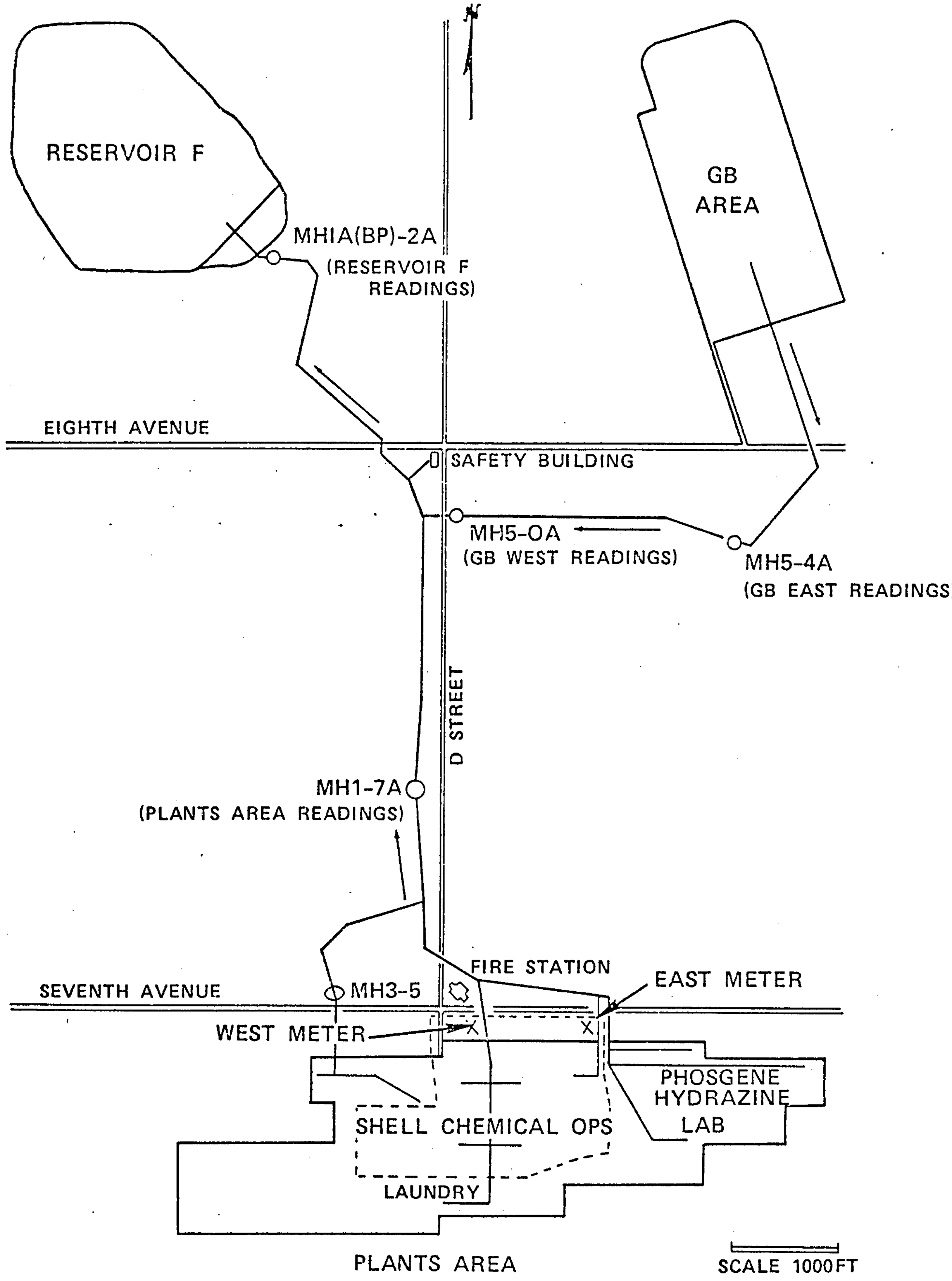
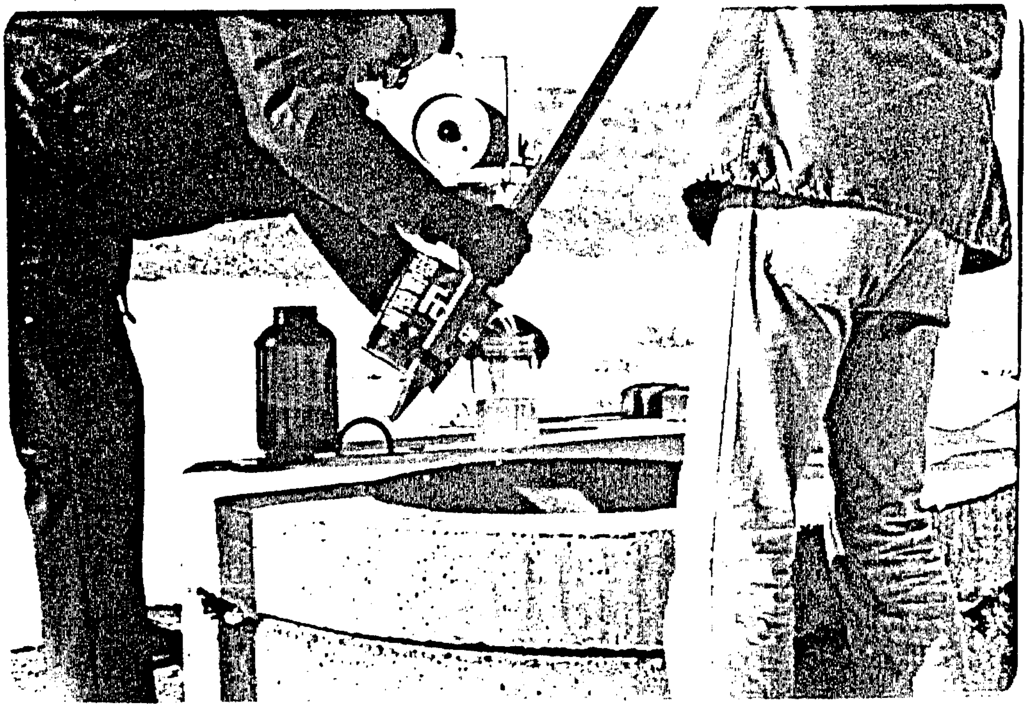


FIGURE 2

WASTE WATER SYSTEM



Sample being taken at MH 1-7
26 Jan 78

Basin F Contents
26 Jan 78

FIGURE 3: Photographs of Liquid Wastes at RMA

Sample of Basin F Influent

26 Jan 78

Sample from East Meter (Shell Area)

26 Jan 78

FIGURE 3 (Continued)

TABLE 1

Chemical Sewer Monitoring

26 Jan 78

1. Sampling sites selected for subject monitoring were as follows:

a. East Meter Pit, Shell Area.

b. West Meter Pit, Shell Area.

c. Manhole #3-5, located 50' north of 7th Avenue and 800' west of "D" Street.

d. Meter pit at Manhole #1-7, located 175' west of "D" Street and 2,100' north of 7th Avenue.

e. The inlet pipe to Basin F.

2. The following information applies to samples taken 26 Jan:

a. East Meter Pit -- Log #PX 0301, taken at 1345 -- Meter indicating 30 gpm, totalizer reading 210,444,100 gallons.

b. West Meter Pit -- No flow through metering flume at 1330 (recheck at 1500, no flow), no sample taken. Meter indicating 25 gpm, totalizer reading 99,512,000 gallons.

c. Manhole #3-5 -- Log #PX 0302, taken 1405, estimated 2 gpm flow.

d. Manhole #1-7 -- Log #PX 0303, taken 1420, flow meter inoperative, unable to estimate flow.

e. Basin F Influent-- Log #PX 0304, taken 1435, flow meter inoperative, unable to estimate flow.

TABLE 2

Chemical Sewer Monitoring

27 Jan 78

Subject monitoring samples were taken on 27 Jan 78 as indicated:

a. East Meter Pit -- Log #PX 0305, taken 0655, indicated flow rate 52 gpm, integrator total 210,492,400 gallons.

b. West Meter Pit -- No flow through metering flume, no sample taken. Indicated flow rate 17 gpm, integrator total 99,524,420 gallons. Malfunctioning meter was brought to attention of Shell on 26 Jan 78.

c. Manhole #3-5 -- Log #PX 0307, taken 0705, estimated flow 2 gpm.

d. Manhole #1-7 -- Log #PX 0306, taken 0715.

e. Basin F Influent-- Log #PX 0308, taken 0725.

TABLE 3

Chemical Sewer Monitoring

28 Jan 78

Subject monitoring samples were taken on 28 Jan 78 as indicated:

a. West Meter Pit -- Log #PX 0309, taken 0806, indicated flow rate 53.0 gpm, integrator total 99,580,470 gallons. Pen chart showed 48.0 gpm.

b. East Meter Pit -- Log #PX 0810, time 0818, no flow apparent, meter reading was 5 gpm, integrator reading 210,536,400 gallons.

c. Manhole #3-5 -- Log #PX 0311, taken 0832, estimated flow 3 gpm.

d. Manhole #1-7 -- Log #PX 0312, taken 0845, estimated flow 25-30 gpm.

e. Basin F Influent -- Log #PX 0313, taken 0917, estimated flow 10-30 gpm.

TABLE 4

SHELL EAST METER
(See Figure 2)

Inorganic[1, 2]	26 Jan 78	27 Jan 78	28 Jan 78	Average Reported by Shell (Feb 76-Jan 77)
pH	10.8	1.4	7.6	9.4
Dissolved Solids	25,000	28,000	43,000	41,000
Inorganic Nitrogen	2.50	0.44	1.30	
Iron	0.64	58.60	5.00	6.45
Copper	2.67	23.4	10.4	170
Inorganic Chloride	7,750	11,100	13,800	
Ortho Phosphate	54	20.50	7.90	
Total Phosphate	2,300	1,010	1,960	
Sulfate	340	53	606	
Soluble Organics			5,600	2,820
Sodium	7,380	3,840	12,000	

NOTE: [1]Quantities expressed in milligrams per liter.

[2]See Table 7 for published water quality standards or guidelines.

TABLE 4 (Continued)

SHELL EAST METER
(See Figure 2)

Organic[1,2,4]	26 Jan 78	27 Jan 78	28 Jan 78	Average Reported by Shell (Feb 76-Jan 77)
Aldrin	0.50			
Atrazine				
Bidrin	50	200	300	
4-Chlorophenyl methyl sulfone		X	X	
Dichlorobenzene				
DDVP (Vapona)				
Dieldrin	1.0			
DIMP				
Methyl Isobutyl Ketone	X	X	X	
Nemagon				
N-Methyl-2-Chloroacetamide				
N,N-Dimethyl Acetonacetamide	X	X	X	
N,N-Dimethyl-2-Chloroacetoacetamide		100	80	
Trimethyl Phosphate				
Xylenes				
Flow[3]	30	52	5	67

NOTE: [1]Quantities expressed in milligrams per liter.

[2]An "X" indicates the compound was identified but not quantified.

[3]Expressed in gallons per minute.

[4]See Table 7 for published water quality standards or guidelines.

TABLE 4 (Continued)

SHELL WEST METER
(See Figure 2)

Inorganic[1, 2]	26 Jan 78	27 Jan 78	28 Jan 78	Average Reported by Shell (Feb 76-Jan77)
pH	NO SAMPLE TAKEN		7.2	6.9
Dissolved Solids	"	"	3,000	15,200
Inorganic Nitrogen	"	"	0.59	
Iron	"	"	0.99	10.31
Copper	"	"	< 0.04	2.4
Inorganic Chloride	"	"	85.0	
Ortho Phosphate	"	"	14.0	
Total Phosphate	"	"	120	
Sulfate	"	"	265	
Soluble Organics	"	"	1,250	2,200
Sodium	"	"	206	

NOTE: [1]Quantities expressed in milligrams per liter.

[2]See Table 7 for published water quality standards or guidelines.

TABLE 4 (Continued)

SHELL WEST METER
(See Figure 2)

Organic[1, 2, 4]	26 Jan 78	27 Jan 78	28 Jan 78	Average Reported by Shell (Feb 76-Jan 77)
Aldrin	NO SAMPLE TAKEN			
Atrazine	"	"	5	
Bidrin	"	"	60	
4-Chlorophenyl methyl sulfone	"	"		
Dichlorobenzene	"	"		
DDVP (Vapona)	"	"	10	
Dieldrin	"	"		
DIMP	"	"		
Methyl isobutyl ketone	"	"	X	
Nemagon	"	"	80	
N-Methyl-2-Chloroacetamide	"	"		
N,N-Dimethyl Acetonacetamide	"	"		
N,N-Dimethyl-2-Chloroacetonacetamide		"		
Trimethyl Phosphate	"	"		
Xylenes	"	"		
Flow[3]			48	16.5

NOTES: [1]Quantities expressed in milligrams per liter.
[2]An "X" indicates the compound was identified but not quantified.
[3]Expressed in gallons per minute.
[4]See Table 7 for published water quality standards or guidelines.

TABLE 4 (Continued)

MH #3-5
(See Figure 2)

Inorganic[1, 2]	26 Jan 78	27 Jan 78	28 Jan 78
pH	8.2	7.1	8.0
Dissolved Solids	1,000	1,000	2,000
Inorganic Nitrogen	0.27	0.06	0.20
Iron	0.13	0.44	0.25
Copper	< 0.04	< 0.04	< 0.04
Inorganic Chloride	160	410	1,000
Ortho Phosphate	6.0	74	2.2
Total Phosphate	5.0	136	< 0.2
Sulfate	32	34	42
Soluble Organics			420
Sodium	87.5	6.4	6.4

NOTE: [1]Quantities expressed in milligrams per liter.

[2]See Table 7 for published water quality standards or guidelines.

TABLE 4 (Continued)

MH #3-5
(See Figure 2)

Organics[1, 2, 4]	26 Jan 78	27 Jan 78	28 Jan 78
Aldrin	NONE DETECTED		
Atrazine	"	"	
Bidrin	"	"	
4-Chlorophenyl methyl sulfone	"	"	
Dichlorobenzene	"	"	
DDVP (Vapona)	"	"	
Dieldrin	"	"	
DIMP	"	"	
Methyl isobutyl ketone	"	"	
Nemagon	"	"	
N-Methyl-2-Chloroacetamide	"	"	
N,N-Dimethyl Acetonacetamide	"	"	
N,N-Dimethyl-2-Chloroacetoacetamide	"	"	
Trimethyl Phosphate	"	"	
Xylenes	"	"	
Flow[3]	2	2	3

NOTES: [1]Quantities expressed in milligrams per liter.
[2]An "X" indicates the compound was identified but not quantified.
[3]Expressed in gallons per minute.
[4]See Table 7 for published water quality standards or guidelines.

TABLE 4 (Continued)

MH #1-7
(See Figure 2)

Inorganics[1,2]	26 Jan 78	27 Jan 78	28 Jan 78
pH	10.7	1.5	6.8
Dissolved Solids	10,000	16,000	2,000
Inorganic Nitrogen	1.00	0.30	0.15
Iron	0.12	28.7	0.56
Copper	0.20	3.9	< 0.04
Inorganic Chloride	2,200	6,400	280
Ortho Phosphate	2.0	9.0	1.5
Total Phosphate	1,960	828	340
Sulfate	138	598	63
Soluble Organics			440
Sodium	2,750	2,340	226

NOTES: [1]Quantities expressed in milligrams per liter.

[2]See Table 7 for published water quality standards or guidelines.

TABLE 4 (Continued)

MH #1-7
(See Figure 2)

Organics[1,2,4]	26 Jan 78	27 Jan 78	28 Jan 78
Aldrin		3	0.5
Atrazine		4	8
Bidrin	40		70
4-Chlorophenyl methyl sulfone			
Dichlorobenzene	X		X
DDVP (Vapona)		20	10
Dieldrin			
DIMP			
Methyl isobutyl ketone			
Nemagon	200	300	90
N-Methyl-2-Chloroacetamide			
N,N-Dimethyl Acetoacetamide			
N,N-Dimethyl-2 Chloroacetoacetamide		100	
Trimethyl Phosphate			
Xylenes	X	X	
Flow[3]			25

NOTES: [1]Quantities expressed in milligrams per liter.

[2]An "X" indicates the compound was identified but not quantified.

[3]Expressed in gallons per minute.

[4]See Table 7 for published water quality standards or guidelines.

TABLE 4 (Continued)

BASIN F INFLUENT
(See Figure 2)

Inorganics[1, 2]	26 Jan 78	27 Jan 78	28 Jan 78
pH	10.10	6.3	7.4
Dissolved Solids	17,000	13,000	2,000
Inorganic Nitrogen	1.00	0.23	0.16
Iron	0.17	8.5	0.36
Copper	1.44	1.13	< 0.04
Inorganic Chloride	3,800	4,250	203
Ortho Phosphate	1.6	12	2.2
Total Phosphate	450	1,460	520
Sulfate	125	610	77
Soluble Organics			820
Sodium	4,780	2,030	218

NOTE: [1]Quantities expressed in milligrams per liter.

[2]See Table 7 for published water quality standards or guidelines.

TABLE 4 (Continued)

BASIN F INFLUENT
(See Figure 2)

Organics[1,2,4]	26 Jan 78	27 Jan 78	28 Jan 78
Aldrin		1	
Atrazine		8	10
Bidrin	80	30	60
4-Chlorophenyl methyl sulfone	X		
Dichlorobenzene	X	X	X
DDVP (Vapona)		20	40
Dieldrin			
DIMP			
Methyl isobutyl ketone			X
Nemagon	200	250	90
N-Methyl-2-Chloroacetamide			
N,N-Dimethyl Acetoacetamide	X	X	X
N,N-Dimethyl-2 Chloroacetoacetamide		300	
Trimethyl Phosphate			
Xylenes		X	
Flow[3]			20

NOTES: [1]Quantities expressed in milligrams per liter.

[2]An "X" indicates the compound was identified but not quantitied.

[3]Expressed in gallons per minute.

[4]See Table 7 for published water quality standards or guidelines.

TABLE 5

Laboratory Procedures for GC/MS

Procedure for analyses of chemical sewer samples:

a. Fifty ml of the aqueous mixture was added to a separatory funnel, 2 ml of methylene chloride was added, and the mixture was shaken for about 2 minutes.

b. The methylene chloride extract was drained into a hypovial, then analyzed directly by a gas chromatography-mass spectrometer data system.

c. A standard solution was made by adding weighed quantities of the analytes to methanol. One-half ml of the solution was added to 50 ml of distilled water and the above extraction procedure was followed. The peak areas were obtained from the data system to calculate the concentrations.

TABLE 6

Shell Chemical Plant Production
26-28 Jan 78

Bidrin

Atrazine F

Vapona (DDVP)

Nudrin

TABLE 7

WATER QUALITY CRITERIA FOR
APPLICABLE COMPOUNDS AT RMA

Aldrin	.001 mg/l[1]
Atrazine	.150 mg/l[4]
Bidrin	None
4-Chlorophenyl methyl sulfone	None
Dichlorobenzene	15 mg/l[2]
DDVP (Vapona)	None
Dieldrin	.001 mg/l[1]
DIMP	0.5 mg/l[3]
Methyl isobutyl ketone	20.5 mg/l[2]
Nemagon	None
N-methyl-2-chloroacetamide	None
N-N-Dimethyl acetoacetamide	None
N-N-Dimethyl-2-chloroacetoacetamide	None
Xylenes	4.35 mg/l[2]
Trimethyl phosphate	0.1 mg/l[1]

NOTES: [1]1972 water quality standards (recommendations from NAS to EPA).

[2]NTIS report from TRW Systems Group to EPA (provisional limit) August 1973 (carcinogenesis studies are in progress).

[3]Temporary guideline (NAS) based on animal feeding studies.

[4]Suggested level, Vol. 42, Federal Register, 11 Jul 77.

TABLE 7 (Continued)

WATER QUALITY CRITERIA FOR
APPLICABLE COMPOUNDS AT RMA

Dissolved Solids		500 mg/1[1]
Nitrogen		10 mg/1[2]
Iron		0.3 mg/1[2]
Copper		1.0 mg/1[2]
Chloride		250 mg/1[2]
Phosphates	No recommendations have been made due to complexity of environmental interaction[3]	
Sulfate		250 mg/1[2]
Sodium		250 mg/1[4]
pH		5.0-9.0[2]

NOTES: [1]1962 drinking water standards (PHS 1962).

[2]Drinking water criteria, EPA July 1976.

[3]Water Quality Criteria 1972 (recommendations to EPA from NAS).

[4]State of Colorado guideline (NAS recommends no limit)